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1 Recording Apparatus

BACKGROUND OF THE INVENTIONField of the Invention

5 The present invention relates to a recording apparatus for recording the image information.

Related Background Art

Conventionally, a recording apparatus of this kind has been well known in which it comprises disc
10 driving means having a motor and a memory, which disc driving means is started in a recording wait (stand-by) mode, thus waiting for the recording.

However, with such a conventional example, as the electric current is consumed more than necessary
15 by the disc driving means even during the waiting for recording, there was a problem to be resolved in connection with the recording apparatus driven by a battery (cell) such as an electronic still camera (SV camera), that the exhaustion of battery is severe,
20 and the internal temperature of the apparatus is raised with the heat due to the current consumed.

Also, with a conventional electronic still camera, it has been proposed that a picked up image is once recorded onto an intermediate recording
25 apparatus (image memory or buffer memroy), before it is recorded onto a magnetic disc or semiconductor memory (memory card) which is an ultimate recording

1 medium.

For example, upon a first stroke of the release operation, the power is supplied to an image pickup element and a buffer memory for signal processing,
5 and the magnetic disc which is an ultimate recording medium is started, and upon a second stroke of the release operation (and stabilization of rotation of the magnetic disc), an image picked up by the image pickup element is recorded via the buffer memory into
10 the magnetic disc.

There was disclosed a constitution in Japanese Patent Application Laid-Open No. 64-16081 in which a picked up image is temporarily stored in the intermediate storage device (frame memory), the
15 magnetic disc is started at an appropriate later stage, and the image stored in the intermediate storage device is transferred and recorded to the magnetic disc. This constitution has an advantage that the consumption power at the peak can be reduced
20 because whether or not the image is recorded onto the magnetic disc can be selected after picking up the image, and the set up speed of rotation of the magnetic disc can be relatively made slower.

Moreover, there was also disclosed a
25 constitution in Japanese Patent Application Laid-Open No. 1-101079 in which a image stored in the intermediate recording medium can be output to the

1 monitor, and a judgment can be made by seeing the
monitor screen whether or not the image is recorded
onto an ultimate recording medium. With this
constitution, the magnetic disc is started in
5 accordance with an instruction from the user that
the image recorded in the intermediate recording
medium is recorded onto the magnetic disc which is an
ultimate recording medium. Thereby, the power
consumption due to the start and rotation of the
10 magnetic disc can be reduced.

With the first conventional example as above
described, there is a drawback in the case of battery
drive that the load of battery is large and the life
of battery is short, because a large amount of
15 electric power is consumed at a time with the
concurrent feed to the buffer memory and the drive
system for the magnetic disc.

With the second and third conventional examples,
the power consumption at the peak in photographing can
20 be reduced, but not sufficiently. Also, with the
third conventional example, the user's operation is
necessary to transfer image from the intermediate
storage medium to the ultimate recording medium, so
that the operativity in continuous photographing is
25 lowered.

As is the case with a silver salt film camera,
when the magnetic disc or semiconductor memory (memory

1 card) which is an ultimate recording medium is not
loaded, or has no empty area even if it may be loaded,
a caution or notice with an indication is displayed to
prompt the user to load or exchange the magnetic disc.

5 The shutter chance may occur before exchange of
the magnetic disc.

SUMMARY OF THE INVENTION

It is an object of the present invention to
10 provide a recording apparatus which can resolve the
above-mentioned problems totally or separately.

Also, it is another object of the present
invention to provide a recording apparatus having a
higher power-saving effect as compared with a
15 conventional apparatus.

Also, it is another object of the present
invention to provide an image recording apparatus with
the improvement of the operativity at the continuous
recording.

20 To accomplish the above objects, in one
example according to the present invention, there is
disclosed a recording apparatus comprising image
pickup means for converting an object image into an
electric signal, temporary storage means for temporarily
25 storing the information of picked up image by the image
pickup means, recording means for recording and holding
the image information read out from the temporary storage

1 means, trigger generating means for generating a
record trigger signal, power supply means for supplying
a necessary power to the image pickup means, the
temporary storage means and the recording means, and
5 control means for controlling the image pickup means,
the temporary storage means, the recording means and
the power supply means in such a way as to feed the
power to the image pickup means and the temporary
storage means in accordance with a trigger signal from
10 the trigger generating means, writing temporarily the
image information to be recorded into the temporary
storage means, feeding the power to the recording means,
after the start of writing into the temporary storage
means, to thereby transfer the image information from
15 the temporary storage means to the recording means.

Also, it is another object of the present
invention to provide a recording apparatus capable of
coping with the event where the ultimate recording
medium is not mounted or has no empty area.

20 Other objects and features of the present
invention will be apparent by way of the ensuring
examples and from the description of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Fig. 1 is a block diagram showing a basic
configuration in a first example of the present
invention.

1 Fig. 2 is a block diagram showing a circuit
configuration of an apparatus in one example of the
present invention.

 Fig. 3 is a flowchart showing one example of
5 an operation procedure for the apparatus in the
example of Fig. 2.

 Fig. 4 is a block diagram showing a configuration
in a second example of the present invention.

 Fig. 5 is a flowchart of a routine in turning on
10 the power in the example of Fig. 4.

 Fig. 6 is a part of flowchart for the
photographing operation in the example of Fig. 4.

 Fig. 7 is a part of flowchart for the
photographing operation in the example of Fig. 4.

15 Fig. 8 is a modified flowchart.

 Fig. 9 is a block diagram showing another
configuration in the second example.

 Fig. 10 is a part of flowchart for the
photographing operation in the example of Fig. 9.

20 Fig. 11 is a part of flowchart for the
photographing operation in the example of Fig. 9.

 Fig. 12 is a part of flowchart for the
photographing operation in the example of Fig. 9.

 Fig. 13 is a part of flowchart for the
25 photographing operation in the example of Fig. 9.

 Fig. 14 is a part of flowchart for the
photographing operation in the example of Fig. 9.

1 Fig. 15 is a part of flowchart for the
photographing operation in the example of Fig. 9.

 Fig. 16 is a part of flowchart for the
photographing operation in the example of Fig. 9.

5 Fig. 17 is a part of flowchart for the
photographing operation in a third example of Fig. 4.

 Fig. 18 is a part of flowchart for the
photographing operation in the example of Fig. 4.

 Fig. 19 is a part of flowchart for the
10 photographing operation in the example of Fig. 4.

 Fig. 20 is a part of flowchart for the
photographing operation in the example of Fig. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

15 The examples of the present invention will be
described in detail with reference to the drawings.

[First example]

 Fig. 1 shows a basic configuration in one
example of the present invention. In Fig. 1, A is a
20 memory for storing the input information, B is a
recording head, C is a disc into which the information
is recorded with the head B, and D is disc driving
means for driving the disc C. E is mode instructing
means for sequentially instructing a first mode of
25 waiting for the recording, and a second mode of
executing the recording. F is control means for
controlling the operation so as to place only the

1 memory B in a wait state in accordance with a first
mode instruction from the mode instructing means E,
and then storing the input information into the memory
B in accordance with a second mode instruction from the
5 mode instructing means E, and concurrently or
afterwards starting the disc driving means D.

The above input information is an information
signal supplied from image pickup means or a host
apparatus, for example.

10 In the following, an example in which the
present invention is applied to an electronic still
camera will be described.

Fig. 2 shows an electrical configuration of
an apparatus in the example of the present invention.
15 In Fig. 2, 1 is a disc, and 2 is a motor for driving the
disc 1. 3 is a head for recording an image signal onto
the disc 1. 4 is an image pickup unit for picking up
an object image, composed of CCD (Charge Coupled
Device), for example. The image signal input from the
20 image pickup unit 4 is processed into a signal form
suitable for the recording method onto the memory 6 or
disc 1 by a signal processing circuit 5.

7 is a CPU (Central Processing Unit) for
controlling the whole of the apparatus, having a
25 program memory internally. 8 is a release switch
(thereinafter abbreviated as SW). The release switch
SW8 turns on a switch (SW) 9 at the first stroke, and

1 also turns on a switch SW10 while holding the switch
SW9 on, at the second stroke.

One example of the operation procedure for
this apparatus having the above configuration is shown
5 in Fig. 3. In Fig. 3, if the release switch SW8 is
depressed into the first stroke instructing a wait mode
for recording, the CPU7 detects the SW9 to be ON (step
S1), and then clears the memory 6 (step S2), thereby
placing the operation into a recording enabled state.

10 At this time, if the release SW8 is returned to
the OFF position, the CPU7 is placed in an initial state
(step S4), but if the release SW8 is further depressed
into the second stroke instructing a recording
execution mode, the CPU7 detects the SW10 to be ON
15 (step S3), thereby driving the image pickup unit 4 to
pick up an image. An image signal picked up from the
image pickup unit 4 is stored via the signal processing
circuit 5 into the memory 6 (step S5).

Subsequently, the driving motor 2 is started and
20 the head 3 is accessed to an appropriate track position
(step S6). And the image signal once stored in the
memory 6 is written via the signal processing circuit
5 into the disc 1 by the use of the head 3 (step S7),
and the recording is completed (step S8).

25 As above described, this example has an effect
that the consumption power is saved and the temperature
elevation within the apparatus can be suppressed by

1 controlling the operation such that only the memory
is placed into the wait state in the recording wait
mode, and the disc driving means is driven in the
recording execution mode.

5 [Second example]

The second example of the present invention
will be described below with reference to the drawings.

Fig. 4 is a block diagram schematically showing
the configuration in one example of the present
10 invention. 11 is a taking lens, 12 is a stop
(diaphragm, aperture), 14 is a stop (diaphragm)
driving circuit for opening or closing the stop 12,
16 is an image pickup element, 18 is an A/D converter
for converting the output of the image pickup element
15 into a digital signal, and 20 is a digital signal
processing circuit (DSP) for performing the signal
processing such as photometry, colorimetry and
compression, using a buffer memory 22 such as a
semiconductor memory.

20 24 is a large memory device for storing a
photographed image ultimately, consisting of a
magnetic disc driver, an optical disc driver, an
optical magnetic disc device and a solid memory device
such as EPROM and battery backed up DRAM. The solid
25 memory device is a so-called memory card. 26 is an
interface between the output of the DSP20 and the
memory device 24.

1 28 is a synchronizing signal generating circuit
(SSG) for supplying a clock or synchronizing signal
necessary for each of the image pickup element 16, the
A/D converter and the DSP20, 30 is a system control
5 circuit for controlling the whole apparatus, 32 is a
power supply battery, 34 is a power supply switch, and
36 is a power supply control circuit for controlling
the power supply to each of the circuits 14 to 28 under
the control of the system control circuit 30.

10 38 is a switch for closing at the first stroke
with a depression of the shutter release button, and
40 is a switch for closing at the second stroke with a
further depression of the shutter release button.
Ordinarily, the system control circuit 30 starts the
15 preparation (photometry, colorimetry) for photographing
in accordance with the closing of the switch 38, and
performs the photograph (i.e., exposure of the image
pickup element 16 and read out therefrom) in accordance
with the closing of the switch 40.

20 The operation as shown in Fig. 4 will be
described with reference to Figs. 2, 3 and 4.

 If the power supply switch 34 is turned on,
the power is fed to the system control circuit 30 to
start the operation. Then the internal circuit is
25 first initialized (S1), the condition for external
interruption with the closing of the switch 38 is set
up (S2), the external interruption is permitted (S3),

1 so that the operation is placed in a wait state (sleep
mode). The sleep mode is a low consumption power mode
in which the contents of registers within the system
control circuit 30 are kept, but the counting operation
5 of counter or the program operation is stopped.
Accordingly, in this sleep mode, even if the power
supply switch 34 is closed, the battery 32 is not
substantially used.

If the switch 38 is first turned on with a
10 depression of the shutter release button, the system
control circuit 30 starts a program as shown in Fig. 6
with an external interruption. That is, the external
interruption is first prohibited (S10) to check for
the switch 38 (S11). If the switch 38 is off (S11),
15 the external interruption is permitted (S18) to place
the operation into the sleep mode, while if the switch
38 is on (S11), the power supply control circuit 36
feeds the power to the image pickup element 16, the
A/D converter 18, the DSP 20 and the synchronizing
20 signal generating circuit 28 (S12), which are operated
in the photometry mode (S13) and then in the colorimetry
mode (S14).

In the photometry mode, for example, the stop
12 is fully opened, the image pickup element 16 is
25 exposed for a predetermined time, and then a
photoelectrically converted signal is read out. The
A/D converter 18 converts the output of the image

1 pickup element 16 into the digital form, and the DSP18
calculates the luminance of object with the weighting
and integration. In the colorimetry mode, the color
temperature of the light illuminating the object is
5 estimated from the luminance of object calculated in
the photometry mode. Based on an estimated color
temperature, the white balance is adjusted.

Until the switch 40 is turned on (S16), the
photometry (S13) and the colorimetry (S14) are
10 repeated; while if the switch 38 is turned off (S38),
the power supply control circuit 36 stops feeding
the power to the image pickup element 16, the A/D
converter 18, the DSP20 and the synchronizing signal
generating circuit 28 (S17), and the external
15 interruption is permitted (S18), so that the operation
is placed in the sleep mode.

If the switch 40 is turned on at the second
stroke of the shutter release (S16), the stop 12 is
controlled (S19) by means of the stop driving circuit
20 14 in accordance with the luminance of object
calculated in the photometry mode (S13), the power is
fed to the buffer memory 22 (S20), and the image pickup
element 16 is exposed for a predetermined time after
removing unnecessary charges (S21). With the exposure
25 of the image pickup element 16, a charge signal is
read out, converted into the digital signal with the
A/D converter 18, and applied to the DSP20 (S22).

1 The DSP20 makes the gamma and knee corrections
to adjust the white balance in accordance with the
color temperature in the colorimetry mode, compresses
the digital signal with a predetermined compression
5 method, and writes the processed digital data into the
buffer memory 22. Note that the contents of buffer
memory 22 should be cleared before writing of the
buffer memory 22. This is because with the compression
of a variable-length coding method, previously
10 photographed image data may remain in the buffer
memory 22, or random initial data may be stored
therein when the power is turned on. Accordingly,
clearing of the memory allows proper data to be stored.

Then, the power control circuit 36 stops feeding
15 the power to the image pickup element 16 and the A/D
converter 18 (S23), and feeds the power to the interface
26 and the memory device 24 (S24). The data stored in
the buffer memory 22 is read out, and transferred via
the DSP20 and the interface 26 in the memory device 24
20 to record the data (S25). After recording into the
memory device 24, it stops feeding the power to the
interface 26 and the memory device 24 (S25), and to
the buffer memory 22 and the synchronizing signal
generating circuit 28 (S27).

25 If the switch 40 is turned off (S28), the
switch 38 is checked (S29), in which if it is off, the
external interruption is permitted, so that the operation

1 is placed in the sleep state (S18), while if it is
on, the photometry and the colorimetry following the
step S12 are continued. At steps S28 and S29, one
frame of image is recorded into the memory device 24
5 with one release operation, but in a half-depressed
state of the release button, the photometry and the
colorimetry are continued.

As will be understood from the above
description, the memory device 24 of this example
10 uses an electric power of the battery 32 in the
operation for recording the image information, while
it does not use the battery 32 to hold the recorded
information.

In the above example, the compressed information
15 is stored in the buffer memory 22, so that the storage
capacity necessary for the buffer memory 22 can be
reduced. On the other hand, it will be appreciated
that the image information with the gamma and knee
corrections applied and the white balance adjusted is
20 stored in the buffer memory 22, and the DSP20 may
compress them with a predetermined compression method
prior to the transfer to the buffer memory 22 or from
the buffer memory 22 to the memory device 24.

The operation after turning on the switch 40
25 can be changed as shown in the flowchart of Fig. 5.
Referring now to Fig. 8, if the switch 40 is turned
on (S16), the stop is controlled (S30) via the stop

1 driving circuit 14 in accordance with the luminance
of object calculated in the photometry mode (S13),
and after removing unnecessary charges from the image
pickup element 16, the exposure is started (S31).

5 The power is fed to the buffer memory 22, taking into
consideration the set up of the power supply voltage
to the buffer memory 22, so that the buffer memory
22 may be placed in a normal operating state at the
completion of the exposure (S32).

10 In this way, if the power is fed to the buffer
memory 22 so that the buffer memory 22 may be in
the normal operating state at the completion of the
exposure of the image pickup element 16, the feed time
to the buffer memory 22 can be minimized.

15 After the completion of the exposure for a
predetermined period, a charge signal with the
exposure of the image pickup element 16 is read out,
and written into the buffer memory 22 via the A/D
converter 18 and the DSP20 (S33). The DSP20 makes
20 the gamma and knee corrections, adjusts the white
balance in accordance with the color temperature in
the colorimetry mode, compresses the data with a
predetermined compression method, and writes the
processed digital data into the buffer memory 22.

25 Note that the contents of the buffer memory 22 should
be cleared before writing into the buffer memory 22,
as in Fig. 4.

1 The power is fed to the interface 26 and the
memory device 24 upon writing into the buffer memory
22 (S34), and the data is transferred from the buffer
memory 22 to the memory device 24 (S35). That is,
5 the data stored in the buffer memory 22 is
sequentially read out, transferred via the DSP20 and
the interface 26 to the memory device 24, and
recorded (S35).

 If the writing into the buffer memory 22 has
10 been completed (S36), the feed to the image pickup
element 16 and the A/D converter 18 is stopped (S37),
and if the transfer of data has been completed from
the buffer memory 22 to the memory device 24 (S38),
the feed to the DSP20, the buffer memory 22 and the
15 synchronizing signal generating circuit 28 is stopped
(S39).

 Thereinafter, as in steps S28 and S29 of Fig.
7, if the switch is turned off (S40), the switch is
checked (S41), in which if the switch 38 is off, the
20 external interruption is permitted, so that the
operation is placed in the sleep state (S18), while
if it is on, the photometry and the colorimetry
following step S12 are continued.

 To perform the operation as shown in Fig. 8,
25 it is necessary to make the writing into and reading
from the buffer memory 22 simultaneously. Therefore,
for the buffer memory 22, a dual port RAM should be

1 used, for example. Also, the DSP22 must have a
circuit configuration in which the write processing
into the buffer memory 22 and the transfer processing
of data read from the buffer memory 22 to the memory
5 device 24 are performed at the same time. Of course,
when the image is compressed for the transfer from the
buffer memory 22 to the memory device 24, the data
read out from the buffer memory 22 is compressed and
transferred to the memory device 24.

10 Usually, the memory device 24 is slower in the
access speed, the time taken for recording one frame
of image to the memory device 24 can be shortened by
simultaneously performing the writing into the buffer
memory 22 and the transfer from the buffer memory 22
15 to the memory device 24.

Fig. 9 is a block diagram of a configuration
in another example of the present invention with the
continuous photographing speed increased. The like
reference numerals are attached to the like components
20 as in Figs. 1 and 9. 42 is a DSP for performing the
digital signal processing such as the photometry, the
colorimetry, the gamma correction, the knee correction,
the white balance adjustment, the compression, etc. by
accessing the buffer memories 44, 46, like the DSP20.
25 The DSP42 is configured such that the writing of data
into the buffer memories 44, 46 and the processing
for data read from the buffer memories 44, 46 and

1 transferred to the memory device 24 can be performed
at the same time.

Note that in this example, each of the buffer
memories 44, 46 use a memory element which has a faster
5 writing speed than that into the memory device 24.

48 is a synchronizing signal generating circuit
for supplying a clock and synchronizing signal
necessary for the A/D converter 18 and the DSP42, 50
is a system control circuit for controlling the whole
10 apparatus, and 52 is a power supply control circuit
for controlling the feed to each section of the circuit
under the control of the system control circuit 50.

Referring now to the flowcharts as shown in
Fig. 10 and the followings, the operation of the
15 example as shown in Fig. 9 will be described below.
Since the routine of closing the power supply switch 34,
and causing the system control circuit 50 to initialize
the system and permit the external interruption is the
same as in Fig. 5, the drawings are omitted.

20 If an external interruption occurs upon turning
on the switch 38, the system control circuit 50 starts
the program as shown in Fig. 10 and followings. That
is, first, the external interruption is prohibited
(S50), and the switch 38 is checked (S51). If the
25 switch 38 is off (S51), the flow proceeds to Fig. 12
as thereafter described, where the external
interruption is permitted (S90), so that the operation

1 is placed in the sleep mode. If the switch 38 is on
(S51), the power supply control circuit 52 feeds the
power to the image pickup element 16, the A/D converter
18, the DSP42 and the synchronizing signal generating
5 circuit 48 (S52).

After the power is fed to the image pickup
element 16, etc., the transfer of previously
photographed image information stored to the memory
device 24 is performed (S53 to S68). This routine is
10 used in the continuous photographing mode, for example,
and the details will be described later.

After processing of stored data in the buffer
memories 44, 46, the system control circuit 50 operates
the image pickup element 16, the A/D converter 18, the
15 DSP42 and the synchronizing signal generating circuit 48
in the photometry mode (S69), and then in the colorimetry
mode (S70). As in Fig. 1, the DSP42 calculates the
luminance of object with the integration and an
appropriate weighting in the photometry mode, and
20 estimates the color temperature of the light illuminating
the object from the luminance of object calculated in the
photometry mode. Based on the estimated color temperature,
the white balance is adjusted.

The processing (S52 to S68) of the buffer
25 memories 44, 46, the photometry (S69) and the colorimetry
(S70) are repeated while the switch 38 is on (S71) and
until the switch 40 is turned on (S91).

1 If the switch 40 is not turned on and the
switch 38 is turned off (S71), all indications are
turned off (S72), and the power supply control circuit
52 stops feeding the power to the image pickup element
5 16, the A/D converter 18, the DSP42 and the
synchronizing signal generating circuit 48 (S73).
And as thereafter described in detail in conjunction
with the flow of Fig. 9, the transfer of data stored
in the buffer memories 44, 46 to the memory device 24
10 is confirmed (S74 to S79, S80 to S89), then the feed
to the DSP42, the buffer memories 44, 46, the interface
26 and the memory device 24 is stopped (S79), and the
external interruption is permitted (S90), so that the
operation is placed in the sleep mode.

15 If the switch 40 is turned on at a second stroke
of the shutter release (S91), the working conditions of
the buffer memories 44, 46 are checked (S92, S93), in
which if both are working, a notice indication for
disapproving to photograph is displayed (S94). Then
20 the operation returns to step S52, where if at least
one of the buffer memories 44, 46 is available (S92,
S93), the photographing is performed.

That is, the flow proceeds to Fig. 10 in
accordance with the luminance of object calculated in
25 the photometry mode (S13), where the stop 12 is
controlled via the stop driving circuit 14 (S95), and
the image pickup element 16 is exposed to the light for

1 a predetermined period after removing unnecessary
charges (S96). Then a determination is made whether
or not the data in the buffer memory 44 has been
transferred to the memory device 24 (S97). If the
5 transfer has been completed, the buffer memory can
be used, while if the transfer has not been completed,
the buffer memory can be used.

Here, assume that both the buffer memories 44,
46 are available. The power is fed to the buffer
10 memory 44 (S98), a charge signal with the exposure of
the image pickup element 16 is read out and applied
via the A/D converter 18 and the DSP42 to the buffer
memory 44, thereby being written into the buffer
memory 44 (S99). The DSP42 performs the gamma and
15 knee corrections, adjusts the white balance in
accordance with the color temperature in the
colorimetry mode, and compresses the data with a
predetermined compression method, if the compression
is required.

20 Then a determination is made whether or not
the buffer memory 46 is available (S100), in which if
it is available (i.e., the data of the buffer memory
46 has been transferred to the memory device 24) (S100),
the feed to the buffer memory 46 is stopped (S101,
25 S102) if the power is being fed to the buffer memory
46, the power is fed to the interface 26 and the
memory device 24 (S103), and the transfer of data

1 from the buffer memory 44 to the memory device 24 is
started (S104).

If all image data of one screen with the image
pickup element 16 has been written into the buffer
5 memory 44 (S105), the feed to the image pickup element
16 and the A/D converter 18 is stopped (S106). As the
writing speed into the buffer memories 44, 46 is faster
than into the memory device 24, the transfer from the
buffer memory 44 to the memory device 24 is never
10 completed before the completion of the writing into
the buffer memory 44.

Next, the flow proceeds to step S107, where a
single photographing mode (S) or a continuous
photographing mode (C) is determined (S107). In the
15 continuous photographing mode, the operation returns
to the photometry and colorimetry routine. On the
other hand, in the single photographing mode, the data
in the buffer memories 44, 46 are continuously
transferred to the memory device 24, while the switch
20 40 is being on (S112). That is, if the transfer from
the buffer memory 46 to the memory device 24 has been
completed (S113), and the power is being fed to the
buffer memory 46 (S114), the feed to the buffer memory
46 is stopped (S115), and the transfer from the buffer
25 memory 46 to the memory device 24 is started (S116).

If the transfer from the buffer memory 46 to the memory
device 24 is not completed (S113), or the feed to the

1 buffer memory 46 is stopped (S114), a determination
is made whether or not the transfer from the buffer
memory 44 to the memory device 24 has been completed
(S117), in which if it has been completed, the feed to
5 the buffer memory 44, the DSP42 and the synchronizing
signal generating circuit 48 is stopped (S118).

For example, if the switch 40 is placed in the
ON state beyond the time taken to transfer the data of
one screen from the buffer memory 44 to the memory
10 device 24, the feed to the buffer memory 44, the
DSP42 and the synchronizing signal generating circuit
48 is stopped (S118).

If the switch 40 turned off (S112), the
operation returns to the photometry and colorimetry
15 routine as long as the switch 38 is on. If the switch
40 is turned off while the transfer from the buffer
memory 44 to the memory device 24 has not been completed,
thus causing the return to the photometry and colorimetry
routine, the detection of the completion for the transfer
20 from the buffer memory 44 to the memory device 24 and
the stop of feed to the buffer memory 44 are performed
within the photometry and colorimetry routine. That is,
if the switch 38 is on, they are processed at steps
S53 to S68, while if the switch 38 is off, they are
25 performed at steps S74 to S89.

Next, after the information of picked up image
is written into the buffer memory 44 in the single

1 photographing mode, and before the transfer from the
buffer memory 44 to the memory device 24 has been
completed, the operation of returning to the photometry
and colorimetry routine with the switch 40 turned off
5 and the switch 38 being on will be described below.

First, for the photometry and colorimetry, the
power is fed to the image pickup element 16, the A/D
converter 18, the DSP42 and the synchronizing signal
generating circuit 48 (S52). Then a determination is
10 made whether or not the transfer from the buffer
memory 44 to the memory device 24 is completed (S53),
and a determination is further made whether or not
the transfer from the buffer memory 46 to the memory
device 24 is completed (S63). As there is no stored
15 data in the buffer memory 46 here, a determination is
subsequently made whether or not the feed to the buffer
memory 46 is made (S64). As the buffer memory 46 is
empty, a notice indication for disapproving to
photograph is turned off (S68), and the photometry
20 (S69) and the colorimetry (S70) are performed. While
the switch 38 is on and the switch 40 is off, the
above routines are repeated, waiting for the completion
of the transfer from the buffer memory 44 to the memory
device 24.

25 The operation in the case where the transfer from
the buffer memory 44 to the memory device 24 is completed
(S53) before a next instruction of photographing (i.e.,

1 turning on the switch 40) will be described below.
In this case, a determination is made whether or not
the power is being fed to the buffer memory 44 (S54).
As the power is being fed, the feed to the buffer
5 memory 44 is stopped (S58). Steps S59 to S62 are the
processing for the case where picked up image data
not yet transferred to the memory device 24 is stored
in the buffer memory 46. Here, since the picked up
image data has not been stored in the buffer memory
10 46, the operation is placed in a state where the
transfer to the memory device 24 has been logically
completed (S59), and the feed is stopped (S60). The
subsequent processing is the same as the initial
processing where the switch 38 is turned on.

15 The case where a next image pickup instruction
(for turning on the switch 40) is issued before the
completion of the transfer from the buffer memory 44
to the memory device 24 will be described. After
the switch 40 is detected to be on (S91), a
20 determination is made whether or not the transfer
from the buffer memory 44 to the memory device 24 has
been completed (S92), in which naturally the transfer
will be determined to be uncompleted, and through a
check for the completion of the transfer from the
25 buffer memory 46 to the memory device 24 (S93), the
operation proceeds to the image pickup routine at step
S95 and the following.

1 After the stop control (S95) and the exposure
(S96), the transfer from the buffer memory 44 to the
memory device 24 is checked for the completion (S97),
in which the transfer will be determined to be
5 uncompleted, so that the power is fed to the buffer
memory (S119), a picked up image signal is read out
from the pickup image element 16 to make the gamma
correction with the DSP42, and written into the buffer
memory 46 (S120).

10 While a check is made to determine that a
picked up image with the image pickup element 16 has
been written into the buffer memory 46 (S121), the
transfer from the buffer memory 44 to the memory
device 24 is checked for the completion (S122), in
15 which if it is completed and the power is being fed
(S123), the feed to the buffer memory 44 is stopped
(S124), and the transfer from the buffer memory 46 to
the memory device 24 is started (S125).

 If the writing of photographed image into the
20 buffer memory 46 is completed (S121), the feed to the
image pickup element 16 and the A/D converter 18 is
stopped (S126), and the continuous photographing in
the single photographing mode is prohibited (S127 to
S135). The processing at steps S127 to S135 is the
25 same as that at steps S107, S112 to S118, and S136.

 Next, the operation in the case where the
writing of photographed image into the buffer memory

1 46 is completed more early than the completion of the
transfer from the buffer memory 44 to the memory
device 24 will be described below.

5 In this case, the flow branches from S121 to
S126 as shown in Fig. 13.

10 Upon completion of the writing of photographed
image into the buffer memory 46 (S121), the feed to
the image pickup element 16 and the A/D converter 18
is stopped (S126), and thereafter, the transfer from
the buffer memory 44 to the memory device 24 is
checked for the completion, irrespective of whether
the switches 38, 40 are on or off, in which upon
completion of the transfer, the feed to the buffer
memory 44 is stopped, and the transfer from the
15 buffer memory 46 to the memory device 24 is started,
and upon completion of the transfer from buffer
memories 44, 46 to the memory device, the feed to the
buffer memories 44, 46, the DSP42 and the synchronizing
signal generating circuit 48 is stopped.

20 More specifically, while the switch 40 is
being on, the above-mentioned operations at steps S129
to S134 are performed. Thereafter, while the switch
38 is being on even if the switch 40 is turned off
(S135), the power is fed to the image pickup element
25 16, the A/D converter 18, the DSP42 and the
synchronizing signal generating circuit 48 (S52)
for the photometry and colorimetry, the transfer from

1 the buffer memory 44 to the memory device 24 is
checked for the completion (S53), and the transfer
from the buffer memory 46 to the memory device 24 is
checked for the completion (S63) if the transfer is
5 uncompleted.

According to a premise for describing the
operation, the transfer from the buffer memory 44 to
the memory device 24 is being performed, and
photographed image data is carried in the buffer
10 memory 46. Accordingly, the transfer from the buffer
memory 46 to the memory device 24 is uncompleted (S63),
and a notice for disapproving to photograph or an
indication of the preparation for photographing is
displayed (S67). Then, the photometry (S69) and the
15 colorimetry (S70) are performed. Thus while the switch
38 is on and the switch 40 is off, the above routine is
repeated, waiting for the completion of the transfer
from the buffer memory 44 to the memory device 24.

If the transfer from the buffer memory 44 to
20 the memory device 24 has been completed (S53), the feed
to the buffer memory 44 is stopped (S58), and the
transfer from the buffer memory 46 to the memory device
24 is started (S62). If the buffer memory 44 is empty,
the photographing operation is enabled, and a notice
25 indication for disapproving to photograph is turned off
(S68). Thereafter, while the switch 38 is on and the
switch 40 is off (S71, S91), the steps S53 to S57 and

1 S68 to S70 are looped, and if the transfer from the
buffer memory 46 to the memory device 24 has been
completed (S55), the feed to the buffer memory 46 is
stopped (S57).

5 If the switches 38, 40 are both turned off
immediately after the transfer from the buffer
memory 44 to the memory device 24 has been completed,
the feed to the image pickup element 16 and the A/D
converter 18 is stopped (S126), and the operation
10 proceeds to step S72 upon the switches 38, 40 being
turned off (S128, S135). That is, all indications are
turned off (S72), the feed to the image pickup element
16 and the A/D converter 18 is stopped (S73), the data
in the buffer memories 44, 46 are transferred to the
15 memory device 24, the feed to the buffer memory to
which the transfer has been completed is stopped, and
if the both data in the buffer memories 44, 46 have
been transferred to the memory device, the feed to
the DSP42, the interface 26 and the memory device 24
20 is stopped (S79), and the external interruption is
permitted, so that the operation is placed in the
sleep mode (S90).

In the above each example, as the buffer
memories 22, 44 and 46, a volatile memory such as
25 SRAM or DRAM was used, but a non-volatile memory
can be of course used. With such a memory, the feed
to the buffer memories 22, 44, 46 can be restricted

1 only during the time of writing and reading, so that
the consumption power can be reduced.

In the example as shown in Fig. 9, when the
buffer memories 44, 46 are both carrying the
5 photographed image data, the photographing is
prohibited, but it will be also appreciated that a
photoelectrically converted signal, i.e., a charge
signal, may be held in the image pickup element 16
without reading it out, in accordance with a special
10 operation, and when one of the buffer memories 44,
46 becomes empty, the charge signal may be read out
from the image pickup element 16, and written into
the empty buffer memory 44 or 46. As the special
operation for instructing the exposure of the image
15 pickup element 16 and the hold of the charge signal,
for example, a depressing operation in the case in
which the release button can be further depressed, or
a switch on operation exceeding a predetermined time
in the case in which a monitor circuit for the switch
20 40 on duration is provided can be considered.

If the charge signal of object image is held
in the image pickup element 16, the image quality
may be degraded owing to dark current or smear, but
a desired object image can be recorded onto the
25 memory device 24. In this case, it is possible to
reduce the smear by narrowing down the stop 12 at
maximum.

1 To hold the charge signal of object image in
the image pickup element 16 serves to resolve a time
lag between the release operation and the exposure of
the image pickup element 16. It is of course
5 necessary to continue feeding the power to the image
pickup element 16 until the charge signal is read out
from the image pickup element 16. When the charge
signal of object image is held in the image pickup
element 16, the retake may be selected by displaying
10 its indication on the display unit.

 The transfer from the buffer memories 22, 44,
46 to the memory device 24 is started before the
completion of the writing from the image pickup
element 16 into the buffer memories 22, 44, 46, but
15 in order to reduce the instantaneous value of the
consumed power, it is preferable to start the transfer
from the buffer memories 22, 44, 46 to the memory
device 24 before the completion of the writing from
the image pickup element 16 to the buffer memories 22,
20 44, 46.

 It is to be noted that in the start of
feeding the power to each block, a predetermined time
necessary for setting up the power supply voltage is
included.

25 In this example, the instantaneous value of
the consumed power can be reduced, so that the
apparatus using a battery as the power supply can

1 make smaller the decrease in the output voltage
owing to the internal resistor of the power supply
battery, whereby firstly, the termination voltage
(the lower limit of available voltage) of the power
5 supply battery can be lowered, and secondly, the
battery with a larger internal resistance (e.g.,
alkaline manganese battery) can be used.

As will be easily understood from the above
description, the instantaneous value of the consumed
10 power can be reduced, so that the drive time can be
lengthened even with a battery of small capacity,
for example.

[Third example]

The third example of the present invention
15 will be described with reference to Fig. 17 and the
followings.

In this example, the configuration of the
apparatus is the same as that shown in Fig. 4, but is
different in the system control of the apparatus, as
20 shown in the flowcharts of Fig. 17 and the followings.

The operation of Fig. 4 will be described with
reference to the flowcharts as shown in Figs. 17, 18,
19 and 20.

If the switch 38 is first turned on, upon
25 depression of the shutter release button, the system
control circuit 30 starts the program as shown in Fig.
17 with an external interruption. That is, first,

1 the external interruption is prohibited (S210), and
the switch 38 is checked (S211). If the switch 38 is
off (S211), owing to a possible cause of noise, a
determination is made whether or not there is any
5 data unsent to the memory device 24 in the buffer
memory 22 (S237), in which if there is any unsent
data, they are sent to the memory device 24 (S214 to
S244, S236), or otherwise (S237), all indications are
turned off (S238), the feed to the buffer memory 2 is
10 stopped (S239), and the external interruption is
permitted (S240), so that the operation is placed in
the sleep mode.

If the switch 38 is on (S211), a determination
is made whether or not the memory device 24 is mounted
15 (S212), in which if it is mounted, a determination is
further made whether or not it has sufficient empty
area to record at least one screen of data (S213).
The detection of such empty area can be performed by
referencing a directory within the memory of the memory
20 device 24, or may be based on other methods.

First, assume that the memory device 24 has
some empty area. Then a notice indication related to
the memory device 24 is turned off (S214), and the feed
to the buffer memory 22 is performed (S215). A
25 determination is made whether or not the buffer
memory 22 has any empty area of at least one screen
(S216), in which if it has not empty area, a caution

1 indication for disapproving to photograph is turned
on (S218), the feed to the memory device 24 and the
interface 26 is performed for the transfer from the
buffer memory 22 to the memory device 24 (S233),
5 while if it has any empty area (S216), a caution
indication for disapproving to photograph is turned
off (S217), and a determination is made whether or
not there is any data unsent to the memory device 24
in the buffer memory 22 (S219). If there is no
10 unsent data (S219), the feed to the buffer memory 22
is stopped (S220), and the photometry and colorimetry
(S221, S222) are performed. If there is any unsent
data (S219), the feed to the memory device 24 and the
interface 26 is performed for the transfer from the
15 buffer memory 22 to the memory device 24 (S233), and
the photometry and colorimetry (S221, S222) are
made.

In the photometry and colorimetry, the power
supply control circuit 36 feeds the power to the
20 image pickup element 16, the A/D converter 18, the
DSP20 and the synchronizing signal generating
circuit 28, which are then operated in the
photometry mode, and in the colorimetry mode. In
the photometry mode, for example, the image pickup
25 element 16 is exposed for a predetermined period with
the stop 12 fully opened, and a photoelectrically
converted signal is read out. The A/D converter 18

1 converts the output of the image pickup element 16
into the digital form, and the DSP18 calculates the
luminance of object with the weighting and integration.
In the colorimetry mode, the color temperature of
5 object illuminating light is estimated from the
luminance information of object calculated in the
photometry mode and the color information of object.
The white balance is adjusted based on the estimated
color temperature.

10 The preparation for photographing can be
completed with steps S212 to S222, while a check is
made to determine whether or not the switch 38 is
turned off (S236). If the switch 38 is on (S236), it
is confirmed that the buffer memory 22 has some empty
15 area (S249), and the operation waits for the switch
40 to be turned on (S250). The steps S12 and the
followings are repeated until the switch 40 is turned
on. If there is no empty area in the buffer memory
22 (S249), the operation returns to step S212, and
20 the transfer to the memory device 24 is made at steps
S216, S218 and S233. More particularly, at step S249,
a determination is first made whether or not the
power is being fed, in which if the feed is ceased,
the presence of empty area is determined, while if the
25 power is being fed, a check is specifically made to
determine whether or not there is any empty area.

 If the switch 38 is off (S236), a determination

1 is made whether or not there is any data unsent to the
memory device 24 in the buffer memory 22 (S237), in
which if there is any data, the data is transferred to
the memory device 24 (S241 to S244, S236), while if not
5 (S237), all indications are turned off (S238), the
feed to the buffer memory 22 is stopped (S239), and
the external interruption is permitted (S240), so
that the operation is placed in the sleep mode.

If the switch 40 is turned on (S250), the stop
10 12 is controlled via the stop drive circuit 14 in
accordance with the luminance of object calculated by the
photometry (S221), and the image pickup element 16 is
exposed (S252). The power is fed to the buffer memory 22
(S253). A charge signal with the exposure of the image
15 pickup element 16 is read out, converted into the digital
signal with the A/D converter 18, and written via the
DSP20 into the buffer memory 22 (S254). Then the DSP20
makes the gamma and knee corrections, adjusts the white
balance in accordance with a color temperature estimated
20 in the colorimetry mode, compresses the data with a
predetermined compression method, and writes the
processed digital data into the buffer memory 22.

Determinations are made whether or not the memory
device 24 is mounted and has any empty area (S255, S257),
25 in which if the memory device 24 is not mounted, an
indication of mounting is displayed (S256), and if it
has no empty area, an indication of exchange is

1 displayed (S258). If the mounted memory device 24 has
any empty area (S257), the power is fed to the memory
device 24 and the interface 26, and the data in the
buffer memory 22 is transferred via the DSP20 and the
5 interface 26 to the memory device 24 (S259). In this
transfer, the data compression may be performed.

After the indication of mounting or exchanging the
memory device 24 is displayed (S256, S258), a determination
is made whether or not the buffer memory 22 has any empty
10 area (S260), in which if there is no empty area, the
operation waits for the memory device 24 to be mounted,
while if there is any empty area, the operation waits for the
switch 40 to be turned off (S261). While the switch 40 is
being on, the processing of steps S255 to S260 is repeated.
15 The reason why the operation waits for the switch 40 to
be turned off is to prevent more than one photograph
from being taken with one release operation. Of course,
if all data in the buffer memory 22 have been transferred
to the memory device 24, the feed to the memory device
20 24 and the interface 26 is stopped.

Next, the operation in the case where the
photographed image information has been recorded onto
the last empty area of the mounted memory device 24 so
that there is no empty area will be described below.

25 The transfer of image data in the buffer memory
22 into the last empty area is started (S259), and
immediately the switch 40 is turned off (S261). Then
the operation returns to step S211.

1 If the switch 38 is also turned off (S211),
a determination is made whether or not there is any
data unsent to the memory device 24 in the buffer
memory 22 (S237). As the transfer from the buffer
5 memory 22 to the memory device 24 has just started,
some unsent data may exist in the buffer memory 22
naturally. The timer (whose function will be
described later) is reset (S241), and determinations
10 are made whether or not the memory device is mounted
and has any empty area (S242, S243). After that, the
feed to the memory device 24 and the interface 26
is made, and the data in the buffer memory 22 is
transferred to the memory device (S244).

15 Note that as the feed to the memory device
24 and the interface 26, and the transfer from the
buffer memory 22 to the memory device 24 have been
already made at step S259, step S244 is duplicated,
but such duplicate control is avoided by means of
20 the software or hardware in the system control
circuit 30 or each of the circuits 16 to 26 which
are controlled by the system control circuit 30.
For example, the flag is set up for each control in
the system control circuit 30, and each circuit 16
25 to 26 is controlled in accordance with a corresponding
flag. Besides, during the operation in accordance
with a certain control instruction on the side of
each circuit 16 to 26, if the same control instruction

1 may be input, the later control instruction is
ignored. Other duplicate controls are similarly
coped with.

While the switch 38 is being off, the steps
5 S237, S241, S242, S243 and S244 are looped, during
which the data in the buffer memory 22 is transferred
to the memory device 24. If the transfer is
completed (S237), all indications are turned off
(S238), the feed to the buffer memory 22 is stopped
10 (S239), and the external interruption is permitted
(S240), so that the operation is placed in the steep
mode.

In the event that the transfer of data from
the buffer memory 22 to the last empty area of the
15 memory device 24 is started, and the switch 40 is
held in the on state until the transfer is completed
(S259, S261), determinations are repeatedly made
whether or not the memory device 24 is mounted and
has any empty area (S255, S257). If the empty area
20 in the memory device 24 is filled upon completion
of the transfer (S257), an instruction of exchanging
the memory device 24 is displayed (S258). A
determination is made whether or not the buffer
memory 22 has any empty area, in which as the transfer
25 to the memory device 24 has been completed, some
empty area naturally exists (S260), and the operation
waits for the switch 40 to be turned off (S261). That

1 is, an indication of exchanging the memory device
24 is continuously displayed (S258).

Next, the instance where the memory device
24 having no empty area is mounted or the photograph
5 is taken without exchanging any new memory device
24 will be described below. The former corresponds
to a case where the switch 40 is once turned off
and then turned on immediately after photographing
onto the last empty area, or a case where the switches
10 38, 40 are turned off without exchange of the memory
device 24 after photographing onto the last empty
area.

When the switch 38 is turned on newly (S211),
and when the switch 38 is held on even if the switch
15 40 is turned off, determinations are made whether
or not the memory device 24 is mounted and has any
empty area (S212, S213). If the memory device 24
is not mounted (S212), a notice indication is
displayed (S223, S224), and if the mounted memory
20 device 24 has no empty area (S213), a notice
indicating that there is no empty area is displayed,
and a notice prompting the exchange of the memory
device 24 is displayed (S225, S226).

The feed to the buffer memory 22 is made,
25 and if there is no unsent data in the buffer memory
22 (S228), the feed to the buffer memory 22 is
stopped (S220), the photometry and colorimetry are

1 made (S221, S222), the switch 38 is checked (S238),
the buffer memory 22 is checked for the presence of
empty area (S248), and the operation waits for the
switch 40 to be turned on (S250). During this time,
5 an indication of mounting or exchanging the memory
device 24 is being displayed. If the switch 38 is
turned off during this time (S238), the operation
is placed in the sleep mode, as previously described
at steps S237 to S240. It will be appreciated that
10 if the consumption power for displaying the indication
of mounting or exchanging the memory device 24 is
sufficiently small, the indication of mounting or
exchanging should be continuously displayed.

If the switch 40 is turned on (S250) in the
15 state where the memory device 24 is not mounted or
has no empty area, a signal is read out from the
image pickup element 16 after controlling the step
(S251), exposing the image pickup element 16 (S252)
and feeding the power to the buffer memory 22 (S253),
20 and processed for the gamma correction, whereby
the data of photographed image is written into the
buffer memory 22 (S254). An indication of mounting
or exchanging the memory device 24 is displayed (S255,
S256, S257, S258), and if there still remains any
25 empty area in the buffer memory 22, the operation
waits for the switch 40 to be turned off (S261),
while if the buffer memory 22 has no empty area (S261)

1 (for example, when the buffer memory 22 has only a capacity of storing as large as one screen of image data), the operation proceeds to step S229.

5 Note that in the event that the switch 38 is on (S211), the memory device 24 is not mounted or has no empty area (S212, S213), and unsent data remains in the buffer memory 22 (S228), the operation proceeds to step S229 as shown in Fig. 18.

10 First, when the memory device 24 is not mounted or has no empty area, the timer for setting the time to hold the data in the buffer memory is reset (S229), and the operation waits for the memory device 24 to be mounted or exchanged (S230, S231), or a cancel switch, not shown, to be operated (S234),
15 until the time is up (S235). If the memory device 24 having some empty area is mounted (S230, S231), the indication related to the memory device 24 is turned off (S232), the feed to the memory device 24 and the interface 26 is performed to transfer the
20 data in the buffer memory 22 to the memory device 24 (S233), and then the preparatory operation for photographing such as the photometry (S221) is entered. Upon operation of the cancel switch, not shown, (S234), or the time up (S235), all indications are
25 turned off (S238), the feed to the buffer memory 22 is stopped (S239), the external interruption is permitted (S240), so that the operation is placed in

1 the sleep mode.

The above-mentioned cancel switch is provided to cancel the release operation when the release operation is falsely made, in the event that the
5 memory device 24 is not mounted or has no empty area. The timer is provided to save the consumption power.

The steps S241 to S243, S245 to S248 are the same as S229 to S231, S234, and S235.

The above-mentioned memory device 24 uses
10 the power of the battery 32 in recording the image information, but may be of the type not using the battery 32 for holding the information to be recorded, for example, a solid memory device such as SRAM or EEPROM backed up by a special-purpose
15 battery, a magnetic disc, a magnetic tape, an optical disc, a laser card or a magneto-optical disc.

It will be appreciated that when the memory device 24 comprises a backup battery for holding the data, the residual capacity of the backup battery is
20 sequentially monitored, whereby if the output is sufficiently decreased so as not to hold the data, an indication of exchanging the memory device 24 may be displayed in the same way as when there is no empty area. Of course, an indication of exchanging
25 or charging the backup battery should be displayed. Under such circumstances, the power for holding the data may be supplied from the battery 32.

1 The indication of mounting or exchanging the
memory device 24 can be made by the voice, rather
than the video, or both of them.

5 While in this example, the time for holding
the data in the buffer memory 22 is restricted (S235,
S248), it will be appreciated that the holding time
may continue as long as the battery 32 lasts, or
whether the holding time is limited or not may be
selected, or the holding time may be adjusted. Even
10 after the holding operation is started, the
serviceability will be raised if the holding time can
be changed.

 As will be easily understood from the above
description, according to this example, the information
15 of photographed image is held in the temporary
storage means when recording means is not mounted
or has no empty area, whereby there will be less
chance of losing the shutter chance.

20

25